Core RF Test board report #4

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Revision: First Draft

Date: 12-Sept-2013

Background.

Validation of results from ACX (in test report QEC-1308092), final PCB layout and u.FL performance.

Equipment used.

Agilent N5230A. 4 port VNA – good to 20GHz, in cal.

Configurations tested.

Analysis of ACX report suggests the V3 layout and the Case 6 component values (see Figure 1) will yield the best result possible. Validate the results using the Johanson eval kit components. This leads to component choices of 3.3nH and 1pF – any difference from the ACX report values will be swamped by component tolerances and/or assembly variances.

In addition, measure the u.FL performance for the V3 layout – which was not performed by ACX.

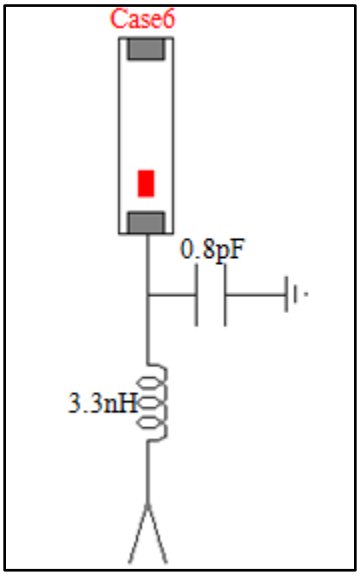

Figure 1. Matching circuit and values from ACX report.

Four RF test boards (numbered 3-01 thru -04) were populated with u.FL connectors and four RF test boards (numbered 3-05 thru -08) were populated with 3.3nH 0603 series inductor (Johanson part

number L-143N3SV4), 1pF 0603 shunt capacitor (Johanson part number 251R14S1R0BV4) and ACX8010 antenna.

Measured results.

The u.FL connectors uniformly showed a transmission loss of approx. 0.5 – 0.75dB. This is acceptable, and may be improved in the production version by increasing the groundplane to microstripline clearance in the vicinity of the connector. Representative results are shown in Figures 2 and 3.

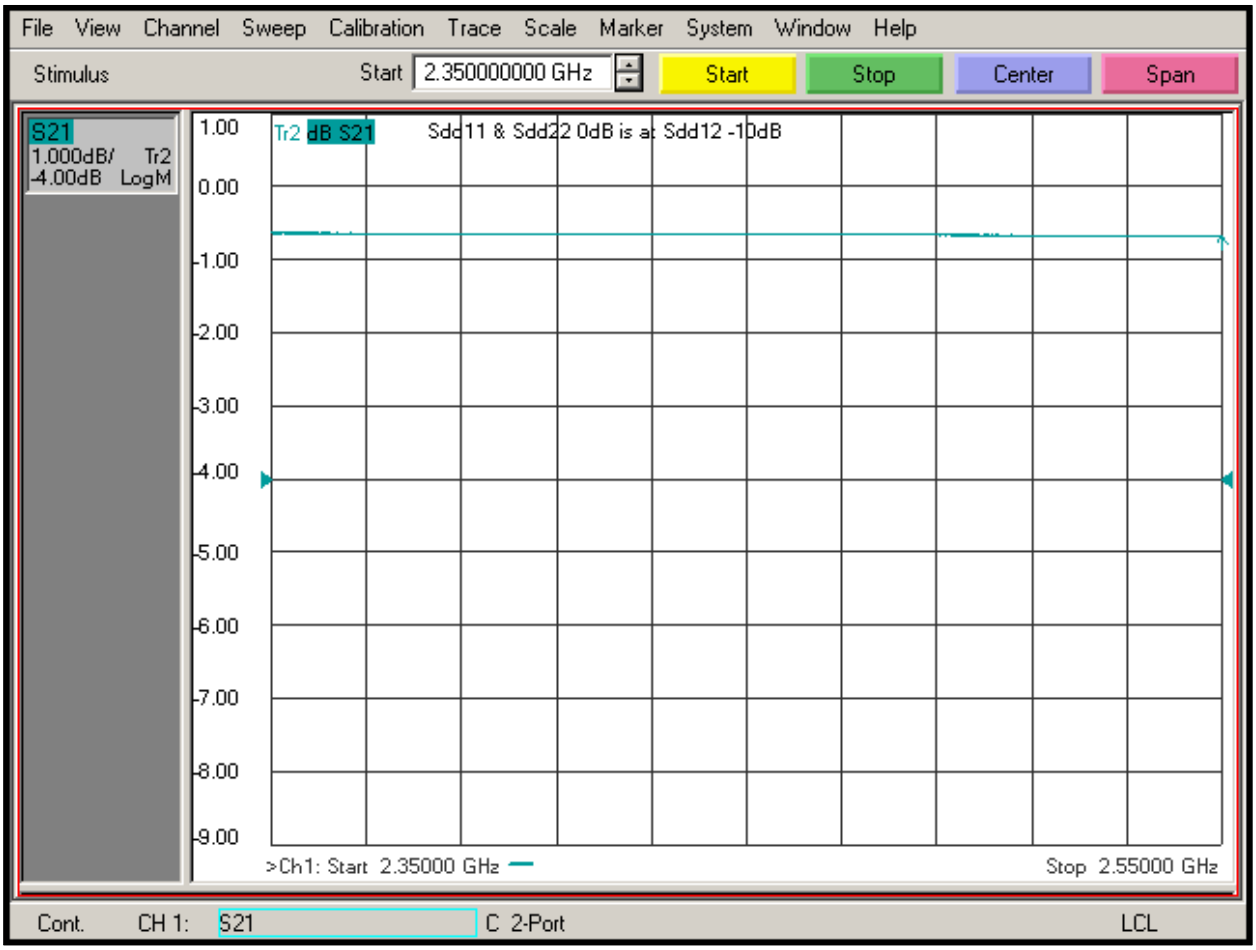

Figure 2. Test Board #3-01 S11 response

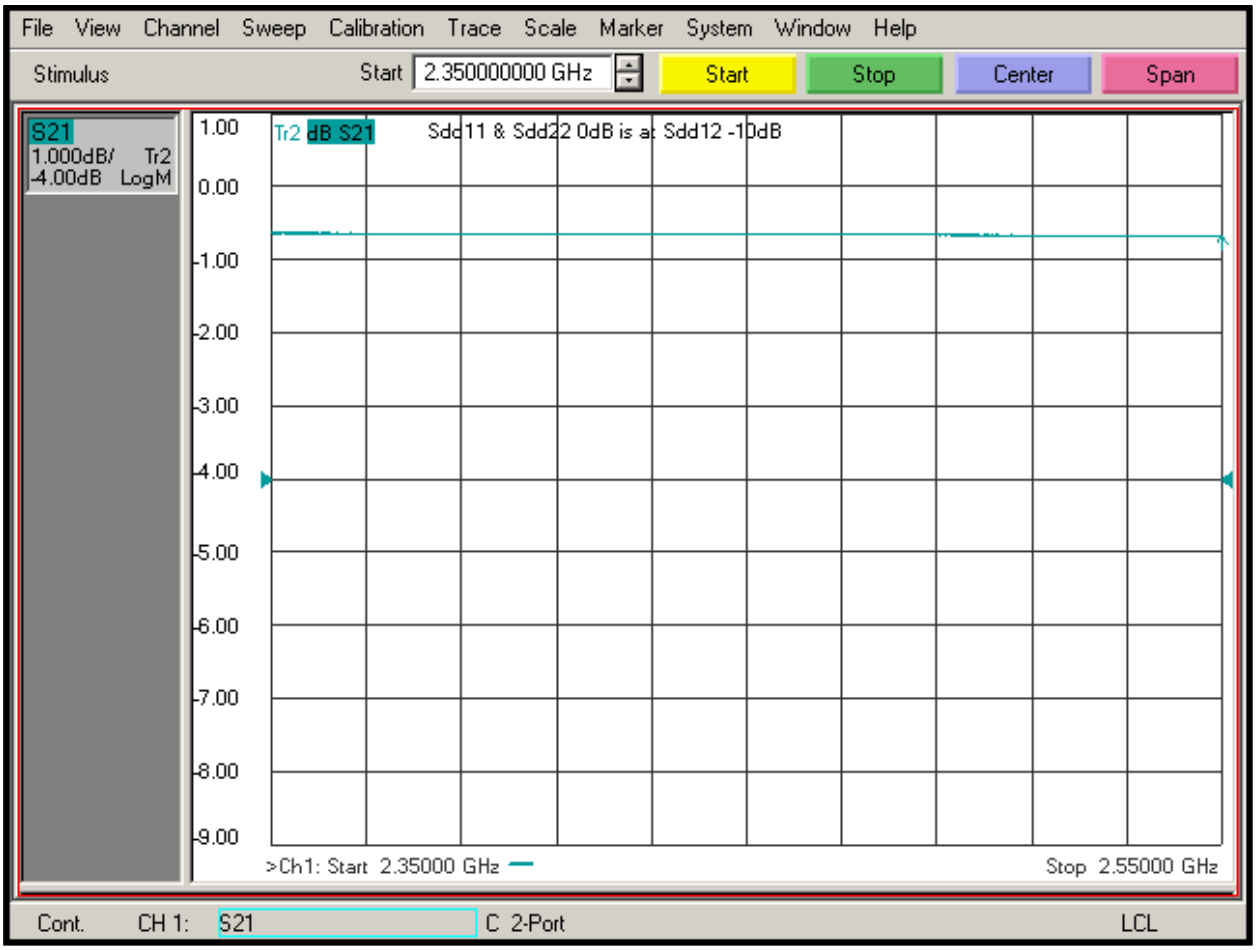

Figure 2. Test Board #3-01 S21 response

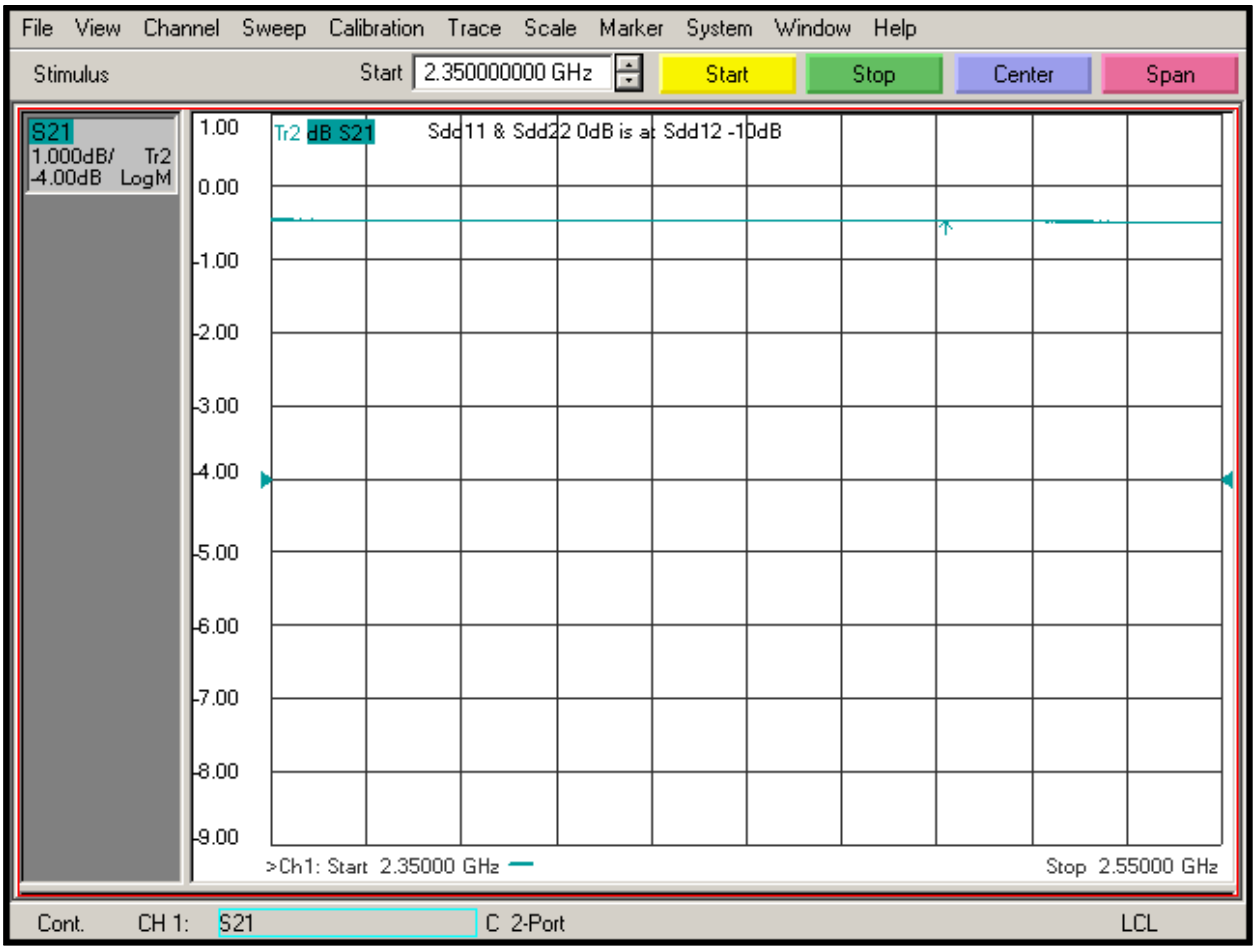

Figure 3. Test Board #3-03 S21 response.

Test board #3-05 malfunctioned, and the results are not reported.

Figures 4-6 show the S11 plot for the remaining 3 boards with chip antennas.

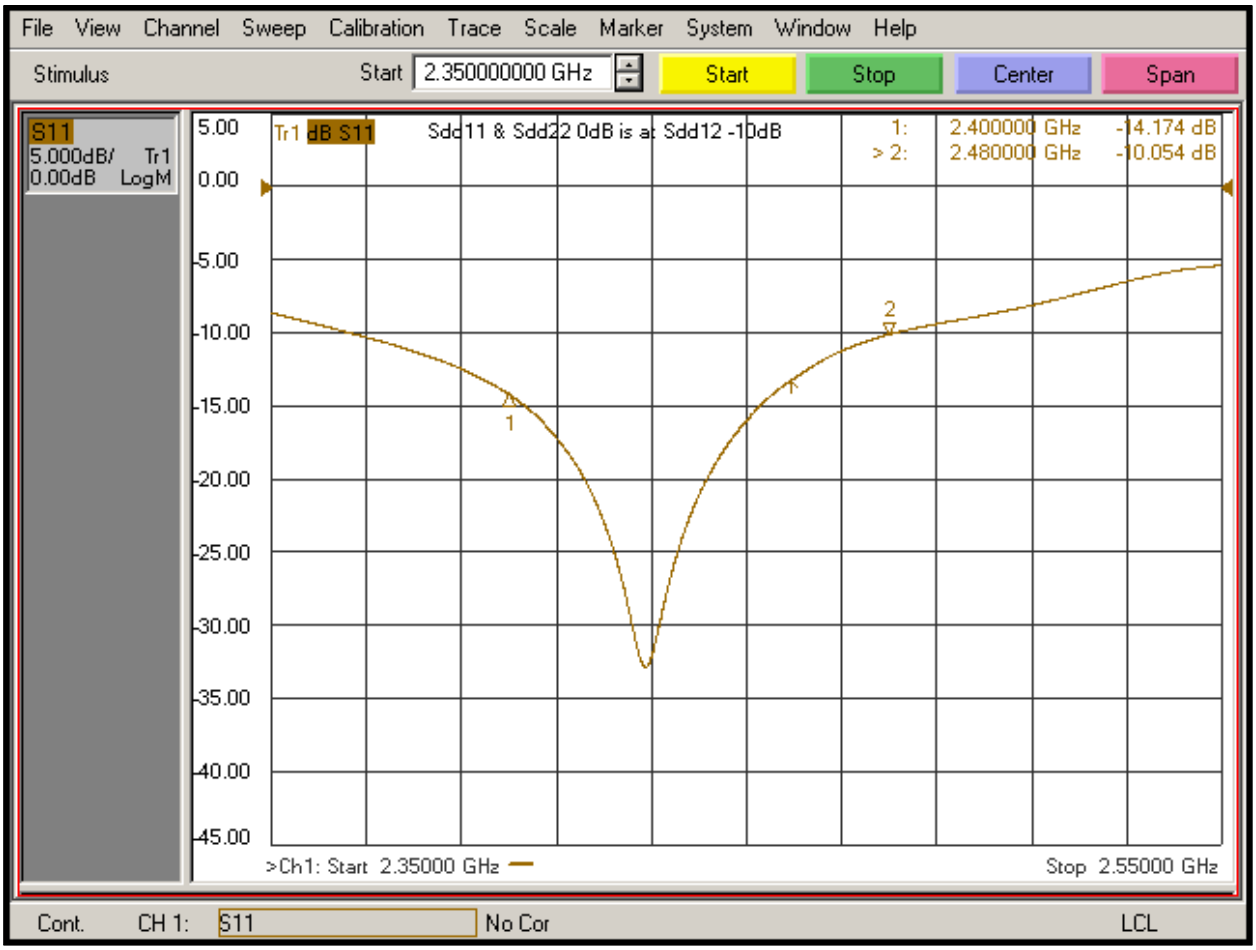

Figure 4. Test Board #3-06 S11 response

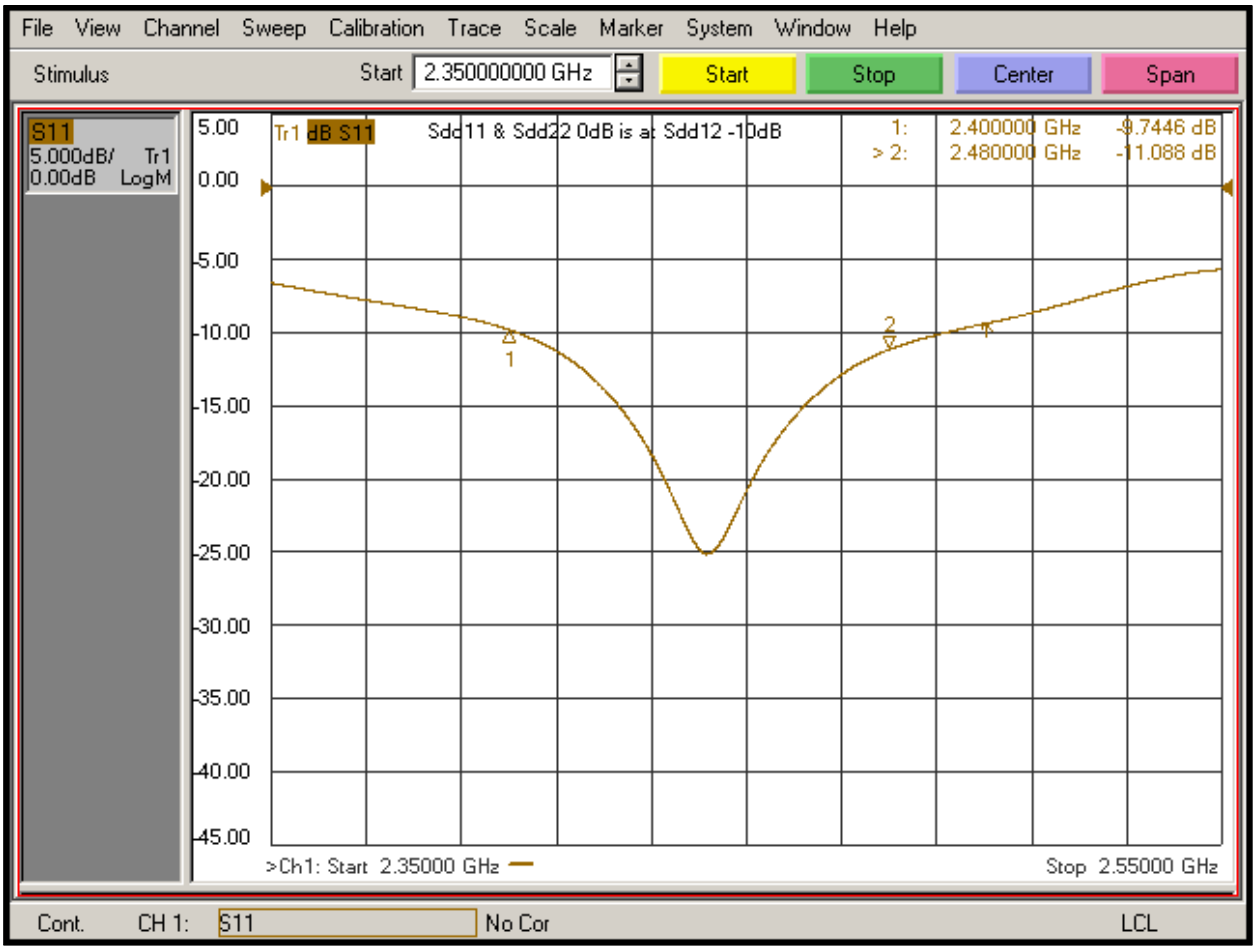

Figure 2. Test Board #3-07 S11 response

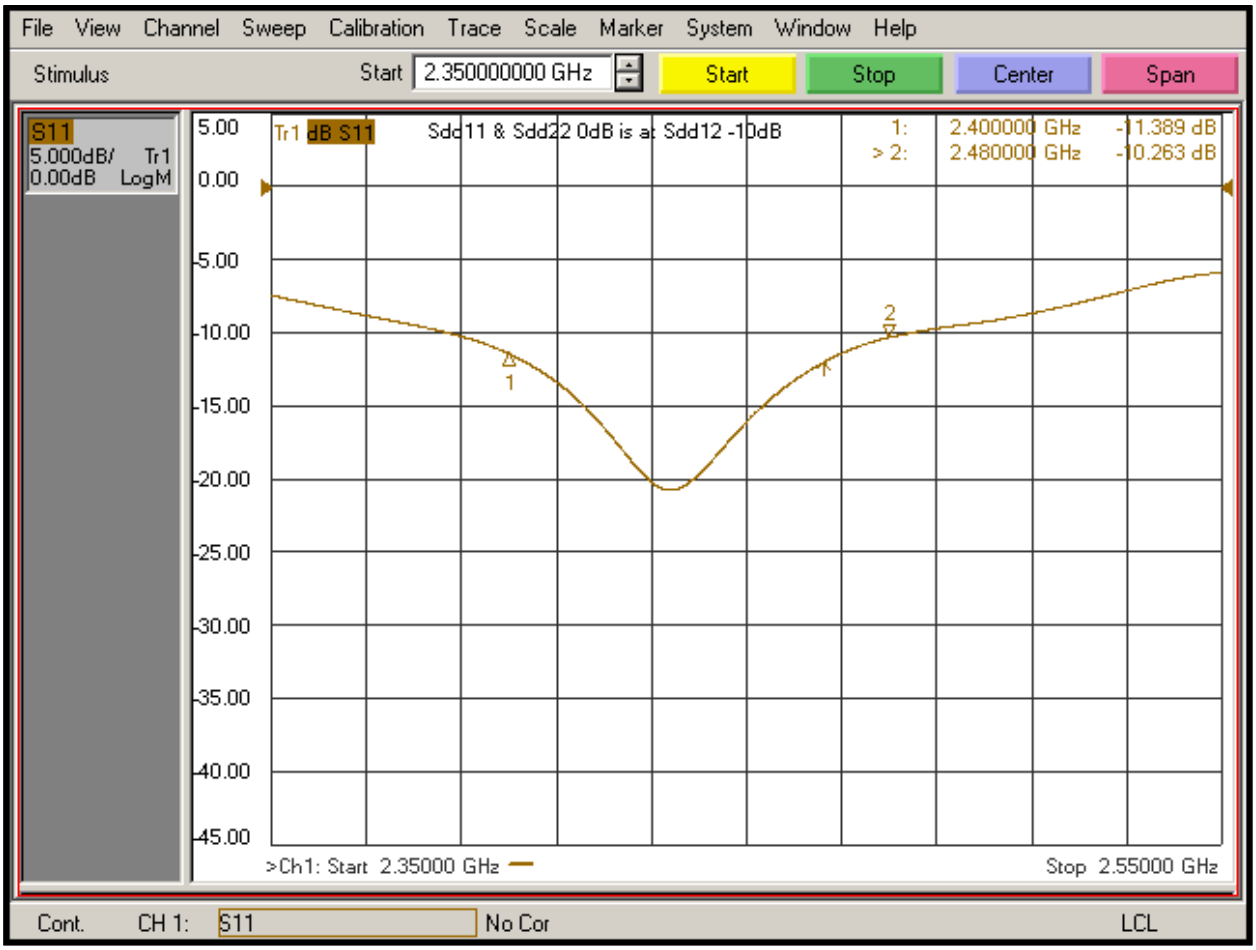

Figure 3. Test Board #3-08 S11 response

These results all fall within the range of acceptable values, with peak return loss in excess of 20dB and centered on the frequencies of interest. These were hand assembled boards, with significant variations in solder thickness, mask registration, and component placement. Production units are likely to show much less variance in performance.

Conclusions.

1. The design and component values for the matching circuit are validated to provide acceptable performance.
2. Release to production with the component values tested here and a layout based on “RF3” is approved.
3. Intentional radiator FCC certification will still apply, because we are using the same antenna that the certification used.

4. Johanson reported that the AT8010 antenna is suboptimal for location parallel to and this close to the groundplane. If a suitable opportunity arises, it may be possible to improve performance and efficiency by using their suggested replacement.
5. As long as we use an antenna with gain less than or equal to the AT8010 (the suggested Johanson replacement fits this description), it is legitimate to continue to apply the certification.

As always raw data & plots is available upon request.